NATIONAL UNIVERSITY OF ENGINEERING
COLLEGE OF ELECTRICAL AND ELECTRONIC ENGINEERING

ELECTRONICS ENGINEERING PROGRAM

EE240 – LABORATORY OF ELECTRICAL MACHINES

I. GENERAL INFORMATION

CODE	**:**	EE240 – Laboratory of Electrical Machines
SEMESTER	**:**	7
CREDITS	**:**	01
HOURS PER WEEK	**:**	03 (Laboratory)
PREREQUISITES	**:**	EE210 – Electrical Machines
CONDITION	**:**	Mandatory

II. COURSE DESCRIPTION

The course includes the principle and/or operation of electric machines, initially with static electric machines such as the iron core reactor and the single-phase transformer; which was studied theoretically in the course of Electrical Machines, in the VI cycle, as well as the experience of formation of magnetic fields in a rotating electric machine and ending with DC and AC rotating machines represented by the Shunt DC engine-generator and AC induction engine respectively. The students will know the principle and/or operation of an electric machine, using the measuring instruments properly and will also compare the experimental results with the theoretical ones given on the data plate, all this in the framework of integration with their groupmates, the which will be useful in their future professional life of teamwork.

III. COURSE OUTCOMES

At the end of the course the student will:

- Adapt to teamwork, when the tasks that each member must perform are distributed within their work group.
- Properly manipulate laboratory equipment (measuring instruments and electrical machines).
- Classify the readings obtained from the measuring instruments (digital multimeters, clamp meters, analogue ammeters, etc.).
- Use and organize the data obtained for the preparation of your final reports.

IV. LEARNING UNITS

1. **THE IRON CORE REACTOR**
   To obtain the B – H characteristic / Separation of Losses / Observation of the Hysteresis Loop and Waveform of the Reactor Current.

2. **THE SINGLE-PHASE TRANSFORMER**
   To obtain Resistance in DC / Vacuum Test / Short Circuit Test / Load Test.

3. **FORMATION OF MAGNETIC FIELDS IN ROTATING MACHINES**
   Formation of a Stationary Field with DC / Rotating Magnetic Field Production.

4. **THE SHUNT MACHINE AS C.C. GENERATOR**
   Vacuum excitation characteristics / Load test / External characteristic / Regulation characteristic.

5. **THE ASYNCHRONOUS MACHINE**
   Free rotor test (vacuum) / Blocked rotor test / Test as a motor under load.

V. LABORATORIES AND PRACTICAL EXPERIENCES

- Laboratory 1: The Iron Core Reactor
- Laboratory 2: The Single-Phase Transformer
- Laboratory 3: Formation of magnetic fields in rotary machines
- Laboratory 4: The DC Machine
- Laboratory 5: The Asynchronous Machine

VI. METHODOLOGY

In these 5 laboratory sessions, the student participates with his team or work group, within an adequate space that is the electricity laboratory. The students will perform the functioning and/or operation of the electric machine and will observe its behavior by reading the Measuring instruments, which will be properly calibrated with both the guidance of the teacher in charge of the course and the laboratory staff.

VII. EVALUATION FORMULA

The learning will be evaluated through the "G" system.
Each laboratory session is qualified, and the one with the lowest grade is eliminated. Besides, at the end of the semester the professor will take a Final Control (FC), this grade will be also averaged with the other laboratory experiences.

$$FA = \frac{L1 + L2 + L3 + L4 + FC}{4}$$

VIII. BIBLIOGRAPHY

- KOSTENKO - PIOTROSKY, Volume II. Electric machines.
- IVANOV - SMOLENSK, Volume II. Electric machines.
- LANGSDORF. Theory of Alternating Current Machines.
- AGUSTÍN GUTIÉRREZ. Theory and Analysis of Electrical Machines.